Winter 2003-04

Big SkyWarn

Spotter Newsletter

Blame It On the Rain (or Lack of It)

Gina Loss

Precipitation for water year 2003 ended below normal for much of Montana, adding another year onto our already long running drought. More than half the state received less than 85 percent of normal precipitation from October 2002 through September 2003. Portions of northwest, southwest and south central Montana received less than 60 percent of normal precipitation. In addition to the lack of precipitation, we were hit with well above average temperatures and several wind events during the mid and late summer. All of this served to diminish the already scarce soil moisture.

Looking at gages with at least 30 years of record, the U.S. Geological Survey monthly-average streamflow for October 2003 indicated that streamflows over much of north central and northwest Montana were lower than the 10th percentile. Virtually all of the rest of the state was in the 10th to 24th percentile. In mid October, the Montana Agricultural Statistics Service rated topsoil moisture as 49% very short, 40% short, 11% adequate and none with a surplus. This was among the worst in the country. The October 1 Water Supply Index, calculated by the Natural Resources Conservation Service, showed all but three of the 52 basins were moderately dry to extremely dry. As of October 1, reservoir storage varied, ranging from a low of 13% of average at Clark Canyon to a high of 104% of average at Lake Elwell. Now, as winter's snow begins to fall, we again dare to hope that this will be the winter to bring relief from the drought.

You can see the U.S. Drought Monitor on the internet at http://drought.unl.edu/dm/monitor.html

NOAA's National Weather Service charges its Climate Prediction Center (CPC) with determining long range forecasts for the nation. Long range forecasting is difficult at best. It is based on climatological trends and climatological phenomena/oscillations. El Niño/ La Niña (above normal or below normal sea surface temperatures over the eastern Pacific Ocean) are opposite phases of the Southern Oscillation. This is just one of several oscillations the CPC monitors. None are yet fully understood from the standpoint of either development or impact. However, as studies continue and correlations are determined, the presence of an El Niño or La Niña event gives CPC forecasters some direction in deriving

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Some Like it Hot

John Blank

Long range forecasts for this winter indicate equal chances of temperatures being either above or below normal. It seems like it has been years since Montana has experienced a hard winter. Arguably the hardest winter Montana experienced occurred way back in 1886-1887. It was during this winter that Charlie Russell worked on a ranch near Utica. The terrible loss of livestock on the ranch during that winter prompted Charlie to paint, "Waiting for a Chinook", possibly his most famous work.

The way 1886 started out, it certainly did not seem like a harsh winter was coming. The spring and summer were unusually dry. On Sept 11, 1886, the Great Falls Tribune reported only 2 inches of precipitation since the beginning of the year. Early in the summer temperatures were hot and they continued hot the remainder of the summer. Despite these conditions cattle streamed into Montana from the Pacific Northwest which led to range being overstocked. In August 100 degree weather led to an outbreak of prairie fires which further depleted range available for grazing.

By autumn some were predicting an open Winter. One cattleman stated, "It has been my experience that when we had a dry summer, an open winter followed." Animals, on the other hand, were forecasting something entirely different. Animals that normally would stay in an area all Winter were heading south.

The first of a seemingly unending series of winter storms hit in the end of November. Snow was followed by rain and the slushy snow developed a hard crust as temperatures plunged below zero. Because of this cattle were unable to feed.

Another storm hit Christmas Eve with temperatures bottoming out at -37 ^{o}F the day after Christmas at Fort Assiniboine. The New Year began with still another storm. Snow on the level over the plains was as high as 16 inches. On January 8th Fort Keough reported a minimum temperature of 50 degrees below zero, which was as low as the thermometer could record. By mid-January the snow was so deep that stagecoach drivers had to use telegraph poles to navigate. On January 14th Fort Keough reported a bone-numbing low of -60 ^{o}F. At the end of January, Yellowstone Park reported snow depths between 6 and 8 feet.

The worst storm of the season raged from January 29th to February 4th. Heavy snow combined with winds as strong as 60 mph and temperatures as low as -60 ^{o}F, produced severe blizzard conditions. Many cattle perished. Another blizzard struck in the middle of February. Fort Assiniboine reported an average temperature for the first ten days of February of –20 ^{o}F.

Finally the chinook arrived the end of February and the snow disappeared almost overnight. What it left was not a pretty sight. Cattle and sheep carcasses were to be seen almost everywhere. The Great Falls Tribune of March 5, 1887, reported at least 200 dead cattle in a 2-mile stretch along the Missouri River in Great Falls. One estimate had 60% of all cattle in Montana dead by the middle of March.

The harsh winter led to a change in the way cattlemen did their business. No longer were cattle left out in the elements without feed or water to fend for themselves.

adapted from "Winter of Calamity 1886-1887" by George Mueller in the book, Montana Weather

The Spirit of NOAA Weather Radio

Jim Brusda

Over the past few months, the NWS has made many changes to NOAA Weather Radio (NWR). Some of the changes were behind the scenes, while others have been more noticeable. The most visible change includes a new transmitter broadcasting near Dillon. Additionally, we installed a new transmitter near Browning and are currently in the testing stage. We plan to have this radio on the air in the near future. With the addition of these two transmitters, we are able to better serve the local communities in these areas, along with the many travelers who pass through each day.

NWR also has another voice improvement. The new voices are Tom and Donna. These voices have come a long way from the original computer voice, and are still being updated.

See page 5 to find the NOAA Weather Radio transmitter that serves you!

Another change you may have already noticed has been with the broadcast cycle. We have tried to make the broadcast cycle as short as possible during quiet weather, so you can get the information you want faster. As a result, the normal broadcast plays the current conditions and the short range forecast every cycle. The extended forecast, climatic data, and a regional weather summary are heard about every 7 to 15 minutes. Of course we will continue to play all warnings, advisories, or watches on every cycle.

One of the requests we heard most often was for a regional climate summary to be aired every day. The regional climate summary includes the high and low temperature and how much precipitation has fallen in your local area. This climate summary can be heard on good weather days from 7 to 10 AM and PM.

NWR will continue to change in order to provide the best possible service to our listeners. You are our most important customer, and any feedback you have is welcome and much appreciated.

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the long range forecast, particularly for the cool season. And generally, the stronger the event, the higher the confidence in the forecast.

So what is in store for this winter? Currently, sea surface temperatures over the eastern Pacific are slightly above average but just below the threshold 0.5 ^{o}C above normal to be considered an El Niño event. During strong El Niño events, the tendency is to have below normal precipitation across central and southwest Montana, especially early in the season. With observations indicating near neutral conditions, there is little to steer the forecast in either a wet or dry direction. As a result, current CPC forecasts are calling for equal chances of above or below normal precipitation through the winter months. Without some confidence that above normal precipitation will fall during the winter, the current outlook indicates the drought will likely persist or intensify over much of central Montana with some improvement expected over the extreme west and extreme east.

Montana is a headwaters state. Our streamflow and reservoir storage is most dependent on mountain snowpack within Montana. It is the mountain snowpack during the coming winter months that will determine our water-supply conditions for the 2004 season and whether we will see some relief from the drought. While the long range forecasts are not overly optimistic, they are neither entirely pessimistic. There is plenty of room to hope for the best.

Word Jumble

OCHOINK

TUGS

NODOGFIL

WEIRDLIF

LITTLESEA

TAGEARSITOONY

SENTMIRRATT

THODRUG

KNAPCOWS

OVERRISER

FATWEROLSM

THRINIFEFGIG

SNOCAATVIEU

RAHHS

TEMPUROC

1. Unscramble these weather words found in articles in this issue

2. Use the letters in the shaded blocks to figure out what the snowman is saying

"Winter is the king of showmen

_ _ _ _ _ _ _   _ _ _ _   _ _ _ _ _ _

_ _ _ _   _ _ _ _ _ _ _"   ~Ogden Nash

Eye in the Sky

Don Emanuel

Today's meteorologists have many resources available to them to help them create the best forecast product for their customers. Some of these resources are of the human variety, the many faithful spotters and cooperative observers, such as yourselves, that provide accurate and timely reports when the weather turns ugly. Other resources involve the use of technology such as computers and RADAR. One such resource that is familiar to just about everyone is the satellite. From newspapers and magazines, to television and the Internet, satellite images of the earth can be seen daily. Satellite images are an important tool for the meteorologist. They not only offer a real-time view of the earth, but they also play an important role for other scientists as well.

Weather satellites help the weather forecaster get an idea of what is happening in areas where no observations can be made. Approximately 70% of the earth's surface is covered by water and satellites keep a close eye on the oceans where hurricanes and typhoons form. Here in Montana, satellite images show us the towering thunderstorms of summer as well as the swirling snow storms of winter. They can also help us see forest fires and satellites proved invaluable during the active fire seasons of the past few years.

The first weather satellite was launched in 1960. Since then, these orbiting marvels have become more and more sophisticated. Weather satellites come in two varieties. The first is a type called geostationary. Geostationary satellites orbit above the earth at 22,300 miles. They remain fixed over the same spot on the earth thereby keeping a continuous eye on the area below them. The second type of weather satellite is a polar orbiting satellite. These travel over the north and south poles and orbit about 530 miles above the earth.

Weather satellites help forecasters in other ways as well. They can monitor snow cover in winter, they can monitor the height of waves on the oceans, they assess crop and forest conditions, and they can follow ash clouds from erupting volcanoes. Weather satellites also save lives. They do this by relaying distress signals from emergency beacons from pilots, mariners or others who are in need of assistance. So far this year, 135 have been rescued in the U. S. with help from weather satellites, over 15,000 persons rescued worldwide since 1982. Always watching, weather satellites are always ready to help us.

NOAA WEATHER RADIO FREQUENCIES

Transmitter	Frequency (MHz)	Counties Served
Bozeman	162.500	northern Gallatin
Conrad	162.500	Toole, Liberty, Pondera, eastern Glacier
Dillon	162.475	Beaverhead, northwestern Madison
Great Falls	162.550	Cascade, western Chouteau, Teton, northern Lewis and Clark
Havre	162.400	Hill
Helena	162.400	southern Lewis and Clark, Broadwater, northern Jefferson, Meagher
Lewistown	162.500	Fergus, Judith Basin, eastern Chouteau

Weird Science, but Typical for Montana

Rick Dittmann

Since we last published, our weather has been quite dramatic. April started off pretty normal with several strong Chinook wind events. On the 9th, a wind gust of 86 miles an hour was recorded 25 miles north of Lincoln. However, the pattern became quite unstable a few days later with severe thunderstorms developing over north central Montana. On the 11th, a lightning strike hit the East Butte Tower Park in Liberty County. The hit kept some televisions off the air for four days. A severe thunderstorm produced 1¼" diameter hail in Great Falls. The following week saw two snow storms move through before another bout of thunderstorms rumbled across the area.

April 22nd saw one of the earliest recorded tornadoes in our area. At 4:47 pm, a tornado touched down 7 miles east of Stanford knocking a combine off its blocks and turning it 45 degrees. Severe weather spotters and law enforcement officials called in the originating funnel cloud to our office enabling our forecasters to get lead time on a tornado warning for the people in and around Stanford. Another tornado was reported 15 miles north of Roy on the 25th. Witnesses reported the tornado was on the ground for 7 minutes.

May saw a few more snow storms and numerous severe thunderstorms, but the month ended with a prolonged warm spell that led to widespread river and lowland flooding. By early June, the Gallatin, Big Hole and Jefferson rivers were over their banks washing out roads and flooding farmland. The remainder of June saw dozens of severe thunderstorms move through north central and southwest Montana. During one particularly ferocious storm in Cascade County, flash flooding developed in the Tracy and Sand Coulee areas. 25 homes received flood damage and surrounding roads were filled with mud and debris from the one to two inches of rain that fell in about 20 minutes. Farther north, a collapsing thunderstorm produced a 100 mph wind gust near Hogelund in Blaine County.

And just that quickly, the severe weather was all but over. July, a typically active month for severe thunderstorms saw our area receive severe weather on only four different days with a total of only nine reports; well below average for the month. What did happen in July was the weather pattern dried out. It got HOT! And it stayed hot throughout the month and well into August. Some severe weather did occasionally accompany the heat. On August 8th, one of the strongest wind gusts ever recorded in Great Falls occurred when a thunderstorm produced an 83 mph gust at the Great Falls International Airport. The storm brought one-inch diameter hail and a brief torrent of rain to the city as well.

Of course, July, August and September will be remembered for the devastating wildfires that started and persisted. Among the largest and most threatening was a complex of fires near Lincoln that caused some evacuations near the city. Smoke from the Lincoln complex and from fires farther north in and near Glacier Park reduced air quality all over north central Montana before a series of September rain and mountain snow storms finally squelched the activity.

Fun Facts

The lowest point in Montana is 1810' on the Kootenai River in Lincoln County. This is higher than the highest point in 11 states!

The warmest temperature ever recorded in Antarctica is 59 °F.

In Montana, we find some way to tolerate the wind. If you think the winds seem a bit stronger this fall, you are correct. After a period of over 12 months of lighter than usual winds, the average speeds have returned to more normal values.

Candle in the Wind

David Bernhardt

Some areas receive their strongest average winds during the spring, when temperatures are struggling to warm after the winter, while others have their strongest winds during the late fall and winter months. Locations near the northern Rocky Mountain Front get their strongest winds during the late fall and winter as the strong jet stream winds pour over the Rockies. A map of average wind speeds would show the strongest winds east of the continental divide, just east of mountain ridges and other higher terrain.

With sensors located at larger airports, we get a general picture of winds across the state. However airport values do not tell the whole story. Montana has varied terrain, in which many local effects can be noted. At airports, the highest average annual wind in Montana is at Livingston at 15.8 mph. Other sensors at more remote locations give a more complete picture. At Blackfoot, the average annual wind speed is 16.4 mph and Heart Butte has an average of 18 mph. The winter months have even stronger averages. In February, Blackfoot has an average wind speed of 26 mph, and Heart Butte peaks in January, with an average of 27 mph.

Peak wind gusts can occur in both winter and summer months. The highest recorded wind gust in Montana, 143 mph, was recorded during a February chinook at the Miller Colony in Teton County. Other very strong gusts have been recorded during summer thunderstorms, including 140 mph in Hill county and 124 mph in Toole county in July.

If you or your neighbor has wind measuring equipment (an anemometer), let us know so that we can get an even better idea of winds across Montana.

Persistent drought conditions over the past five years combined with a very hot and dry July and August made forests throughout Montana tinder-dry. The 2003 fire season began by mid July as record heat baked the state. By the end of July three large fires were burning in and around Glacier National Park. These fires continued to burn through mid September eventually burning 141,000 acres inside the Park.

Burning Down the House

Bernie Meier

Thunderstorms moved across the state August 7th, 8th and 9th starting numerous fires. Especially hard hit was the Missoula area where some evacuations were necessary. On August 21st there were 25 large fires burning in the state, seven of which had already scorched over 20,000 acres apiece. Two of those fires had burned over 40,000 acres each.

Fire Fighters flooded into the state to assist in suppressing these fires. By mid August 70% of all the fire fighting personnel in the country were in the state. Resources became limited and additional resources were called in. An Army battalion from Fort Hood, Texas, assisted firefighting crews on the firelines in the Missoula area. Also, members of the National Guard were called in to help firefighting efforts.

The large fires continued to burn through early September until an autumn storm brought widespread rain and cool conditions to the region. By the time all the flames were out 739,791 acres burned in the state. This amount is slightly larger than the state of Rhode Island.

Fuels remain stressed from years of drought. If hot and dry conditions return next summer another active fire season may be in store.

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As with most weather events, snowfall and snowdepth are quite variable across Montana. Seasonal snowfall averages range from over 300 inches at our higher mountain locations, to less than 15 inches at lower elevation locations in southwest Montana (Glen) and north central Montana (Gildford and Chinook). Lower elevation areas east of the continental divide do not usually have continuous snow cover throughout the winter, due to warmer chinook winds. Though Great Falls receives nearly 65 inches per season, the highest average snowdepth during the winter is two inches! There have been notable storms which left up to 24 inches on the ground. Kings Hill receives over 300 inches per year, Hebgen Dam records about 210 inches, East Glacier collects 176 inches and Shonkin receives 131 inches. Shonkin measured 48 inches on one day in 1982, while Badger Pass (west of Choteau) received about 100 inches in the famous June storm of 2002.

David Bernhardt